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I. THE SILPHINAE OF MINNESOTA

The Silphinae constitute a group of about 250 species of small- to large-sized beetles, which has usually been considered of family rank. For the reasons set forth later, the author is led to reduce them to the rank of a subfamily of Staphylinidae. The student is referred to the table in the second part of the paper for a statement of the characters defining the group.

The primitive members of the Silphinae (Lyrosomini, with filiform antennae) occur for the most part on the Pacific coasts of Asia and North America and are ground inhabitants, being found under cover along streams, on beaches, and on the forest floor. They are, in all probability, predaceous in both larval and adult stages. The more highly specialized members of the subfamily (Agyrtini, Silphini, Necrodini, and Nicrophorini, with clavate antennae) represent the transition (Agyrtini) from a geobious existence to one in close relation to decaying organic matter. This is usually carrion, altho individuals occasionally wander to dung or the fruiting bodies of fungi, and there is a possibility that the last is the normal habitat of at least one species, the very rare *Necrophilus pettitii* Horn. In their new habitat, the adults continue their predaceous proclivities and feed largely upon fly-maggots. They will, however, feed on carrion if driven to it. The larvae appear to be more strictly necrophagous, and they have been raised to maturity on a purely carrion diet. The eggs are laid in the ground in close proximity to the carrion; the larvae mature and transform within a few weeks; and there seems to be but a single generation a year. Hibernation occurs in the adult stage.

The Nicrophorini, or burying bettles, are the most highly specialized tribe of the group. They have the habit of assembling in small numbers under small carcasses, and, by removing the earth underneath the carcass, gradually cause it to become buried. Thereupon the eggs are laid and the adults move on. The larvae are cylindrical eruciform insects with feeble powers of locomotion, condemned to pass their days in the midst of the food supply that their parents have provided.

There are at least three remarkable deviations from the necrobious habits of the majority of the Silphini: (1) The subgenus *Xylodrepa,* which is tree inhabiting and feeds on caterpillars; (2) the subgenera *Ablattaria* and *Phosphuga,* which feed on snails; and (3) the subgenera

Aclypea and *Blitophaga,* which are phytophagous on beets, spinach, and allied plants, and are pests of these crops in Europe and the North American Rocky Mountain region.

The Asiatic highlands have the greatest number of species of the higher tribes of Silphinae. Europe has the next largest number and North America the next. The southern regions—Australasia, Indo-Malaysia, Ethiopian Africa, and South America—have stragglers only, altho these straggling species have often come to represent peculiar types.

Selected bibliography.—For Silphinae in general, Horn. Tr. Am. Ent. Soc. VIII, 1880, pp. 219-275; Reitter, Verh. nat. Ver. Brünn XXIII, 1884, pp. 7-91; and Portevin, Ann. Soc. ent. Belg. LVIII, 1914, pp. 212-225, provide keys to the species of North America, Europe, and Japan, respectively. Keys to the smaller groups exist as follows: **Apteroloma** *(Pteroloma)* and **Lyrosoma:** Semenow, Horae Soc. Ent. Ross. XXVII, 1893, pp. 335-346; **Apatetica:** Fauvel, Rev. Ent. XIV, 1895, pp. 190-194; **Captocerus** *(Pinodytes):* Horn, Tr. Am. Ent. Soc. XIX, 1892, p. 46; **Agyrtes:** Reitter, Wien. Ent. Zeit. XX, 1901, p. 102 (Palaearctic); **Eustadia:** Portevin, Ann. Soc. ent. Belg. LVIII, 1914, p. 199; **Silphini, Necrodini, Nicrophorini:** Portevin, Ency. Ent. VI, 1926, pp. 1-270. Henriksen, Danm. Faun. Bill. V, 1922, pp. 252-260, provides keys in Danish to the larvae of some of the better known European species.

KEY TO SPECIES OF MINNESOTA SILPHINAE[1]

I. ADULTS

1 (2) Posterior coxae separate; elytra with minute strially arranged punctures at base, smooth at apex; Alaska, D.C. Tribe Catopocerini (Pinodytini) ..... *Catopocerus cryptophagoides* Mann.

2 (1) Posterior coxae contiguous; elytra tricostate or smooth

3 (20) Antennae 11-segmented, gradually clavate; elytra tricostate

4 (19) Pronotum narrowed from base to apex; prothoracic spiracles covered. Tribe **Silphini** ..... **Silpha** L.

5 (12) Labrum broadly emarginate; antennae inserted close to eye and distant from margin of front

6 (9) Pronotum emarginate at base..... Subg. **Thanatophilus** Leach.

7 (8) Intervals of elytral costae flat..... **trituberculata** Kby.

8 (7) Intervals of elytral costae tuberculate..... **lapponica** Hbst.

9 (6) Pronotum not emarginate at base..... Subg. **Oiceoptoma** Leach

10 (11) Elytral punctation fine; pronotum unicolorous..... *inaequalis* Fab.

11 (10) Elytral punctation coarser; pronotum black with reddish margins ..... **noveboracensis** Forst.

12 (5) Labrum narrowly and deeply emarginate

[1] Minnesota species are shown in bold-face type; species likely to occur in the state, in italics.

13 (16) Antennae inserted close to margin of front and distant from eye; intervals of elytral costae smooth.....Subg. *Blitophaga* Reit.
14 (15) Form elongate oval; surface pubescent; Palaearctic, Man., Cal., N. J., Colo. .....*opaca* L.
15 (14) Form oblong oval; surface sparsely pubescent; Alb. and Man. to Neb., Colo. and Ore. .....*bituberosa* Lec.
16 (13) Antennae inserted close to eye and distant from margin of front; intervals of elytral costae reticulate
17 (18) Oblong oval; pronotum unicolorous. Subg. **Heterosilpha** Port. ..... **ramosa** Say.
18 (17) Broadly oval; pronotum black with yellow margin. Subg. **Necrophila** Kby. .....**americana** L.
19 (4) Pronotum orbicular; eyes prominent; elytra usually with apical bar orange. Tribe **Necrodini**...**Necrodes (Protonecrodes) surinamensis** Fab.
20 (3) Antennae 10-segmented, capitate; elytra not evidently tricostate, in Minnesota species marked with prominent orange spots or fasciae. Tribe **Nicrophorini** .....**Nicrophorus** Fab.
21 (22) Pronotum with orange disc.....**americanus** Ol.
22 (21) Pronotum unicolorous
23 (42) Pronotum glabrous or nearly so
24 (27) Pronotum orbicular; elytra with erect hairs
25 (26) Metatibiae straight .....**orbicollis** Say.
26 (25) Metatibiae curved .....**sayi** Lap. Cast.
27 (24) Pronotum not orbicular; elytra without erect hairs
28 (39) Metatibiae straight, at least along outer margin
29 (34) Pronotum transverse, sinuate at sides, not strongly cordate (i.e., narrowed behind), widely margined
30 (31) Antennal club black.....**defodiens** Mann.
31 (30) Antennal club with 3 apical segments orange
32 (33) Elytral margin not attaining humerus; elytra without longitudinal raised lines; Palaearctic, Alaska and Manitoba to N. Mex. and Calif., (?) Va. .....*investigator* Zett.
33 (32) Elytral margin nearly attaining humerus; elytra with distinct raised lines .....**pustulatus** Hersch.
34 (29) Pronotum cordate, strongly narrowed behind
35 (38) Metatibiae straight along both outer and inner margin; margin of pronotum wide; disc finely punctate
36 (37) Apical segment of antennal club orange.....**hybridus** H. & A.
37 (36) Antennal club entirely black.....var. **minnesotianus** nov.
38 (35) Metatibiae straight on outer margin, very feebly sinuate along inner margin; margins of prontum narrower, disc coarsely punctate; Alaska and Man. to Kan., N. Mex. and Calif. .....*guttulus* Mots.
39 (30) Metatibiae curved along both margins
40 (41) Basal segment of antennal club black.....**obscurus** Kby.
41 (40) Antennal club entirely orange.....**marginatus** Fab.
42 (23) Pronotum with yellow pubescence.....**tomentosus** Web.

II. LARVAE[2]

1 (13) Ocelli 6 on each side
2 (5) Campodeiform; hind angles of thoracic tergites not produced
3 (4) Prothorax very little narrower than mesothorax; dorsal plates without expanded side margins; side margins not paler.....**Thanatophilus**
4 (3) Prothorax somewhat narrower than mesothorax; dorsal plates with feebly expanded and paler side margins.....**Necrodes surinamensis** Fab.
5 (2) Blattiform; hind angles of thoracic tergites produced
6 (7, 12) Pronotum strongly emarginate in front; margins of dorsal plates strongly expanded, paler.....**Oiceoptoma**
7 (6, 12) Pronotum feebly emarginate in front
8 (11) Dorsal plates narrowly paler; phytophagous.....*Blitophaga*
9 (10) Dorsal plates glabrous(?).....*opaca* L.
10 (9) Dorsal plates with short hairs.....*bituberosa* Lec.
11 (8) Dorsal plates black at margin.....**Heterosilpha ramosa** Say.
12 (7, 6) Pronotum distinctly arcuate in front; margins moderately expanded, not paler .....**Necrophila americana** L.
13 (1) Ocelli 2; eruciform; abdominal tergites with four spines at base.... ..... **Nicrophorus** Fab.

CATALOG OF SPECIES

The specimens upon which the following records are based are deposited in the entomological collections of either the Department of Entomology or the Department of Zoology of the University of Minnesota.

Silpha (Thanatophilus) trituberculata Kby.

A single specimen from Clearwater County (Lake Itasca), May 25. The habitat of this species is unknown, but it is probably carrion.

Silpha (Thanatophilus) lapponica Hbst.

Counties: Bigstone, Cass, Clearwater, Hennepin, Lesueur, Ottertail, Ramsey, Traverse, Wilkin. April 29-Sept. 19. Inhabits carrion. Taken mating on June 7.

Silpha (Oiceoptoma) inaequalis Fab.

This species occurs in Indiana and northern Michigan. It is doubtfully recorded from Manitoba, and may occur in Minnesota. If it occurs at all, it is very rarely, as Minnesota is close to the northern limits of its range.

Silpha (Oiceoptoma) noveboracensis Forst.

Counties: Cass, Clearwater, Hennepin, Lesueur, Ottertail, Ramsey, St. Louis, Wright. April 29-Aug. 28. Inhabits carrion.

Silpha (Heterosilpha) ramosa Say.

Counties: Dakota, Ottertail, Ramsey. June 1-Aug. 14.

[2] The author is indebted to Prof. E. O. Essig for larvae of *ramosa* Say, and to Prof. R. A. Cooley for larvae of *bituberosa* Lec.

Silpha (Necrophila) americana L.

Counties: Blue Earth, Chisago, Clearwater, Crow Wing, Itasca, Lesueur, Nicollet, Ramsey, Wright. June 22-Sept. 19. Inhabits carrion. All the Minnesota specimens belong to the abberation **affinis** Kby., in which the apex of the elytra is distinctly tipped with yellow.

Necrodes (Paranecrodes) surinamensis Fab.

Counties: Clearwater, Hennepin, Lake, Lesueur, Ramsey, Traverse, Washington. June 27-Aug. 30. Inhabits carrion. Taken in light traps in June.

A single specimen from Hennepin County belongs to the ab. **bizonatus** Port., in which there is evidence of a basal elytral fascia. Variations occur nearly all the way from individuals with an anterior fascia composed of three spots and a posterior fascia of four spots to completely immaculate forms.

Nicrophorus orbicollis Say.

Counties: Blue Earth, Chisago, Clearwater, Grant, Hennepin, Lesueur, Nicollet, Pine, Ramsey, Stearns, Traverse. May 24-Sept. 10.

Nicrophorus sayi Lap. Cast.

Counties: Nicollet, Ottertail, Pine, Ramsey, St. Louis—a single specimen from each. July 10-Aug. 28.

Nicrophorus americanus Ol.

Counties: Hennepin, Lesueur, Ramsey, Rice. May 10-Sept. 15. Apparently confined to the southern part of the state.

Nicrophorus defodiens Mann.

Ab. **humeralis** Hatch: humeral end of hypomera orange; elytral fasciae not united on disc. Counties: Clearwater, Lesueur, Hennepin. July 30-Aug. 30.

Type: humeral end of hypomera black; posterior elytral spot large, not constricted; fasciae not united on disc; anterior fascia not interrupted by suture.

Nicrophorus pustulatus Hersch.

Counties: Rice, Pine. Three specimens, June 19-Aug. 24. Taken at light on earlier date.

Nicrophorus hybridus Hatch and Angel

Counties: Itasca, Traverse, Wilkin. Five specimens.

Nicrophorus hybridus var. **minnesotianus** nov.

Type: a single specimen labeled "37" from Ramsey County.

Nicrophorus obscurus Kby.

Counties: Hennepin, Ramsey. Nine specimens.

Nicrophorus marginatus Fab.

Counties: Lesueur, Nicollet, Ramsey. May 31-Sept 6.

Nicrophorus tomentosus Web.

Counties: Bigstone, Hennepin, Lesueur, Nicollet, Norman, Ottertail, Ramsey, Traverse. July 9-Sept. 19.

II. AN INQUIRY INTO THE POSITION OF THE SILPHINAE IN THE STAPHYLINOID SERIES

The difficulty of distinguishing between the Silphinae and the Staphylinidae has gradually become apparent since the revision of the latter by Horn in 1880. Leconte and Horn in 1883, for instance, stated that the abdomen in Staphylinidae is entirely corneous above, and it was apparently on this basis that Sharp first (Ann. Mag. Nat. Hist. (6) III, 1889, p. 467), and then Fauvel (Rev. Ent. XIV, 1895, pp. 180-194) removed *Apatetica* from Silphidae. Fauvel and Ganglbauer (Käf. Mitteleur. III, 1899, pp. 1, 67-68) both pointed out that, in certain genera, which they supposed were restricted to those with a pair of ocelli (Omaliini), the two basal tergites of the abdomen were membranous, whereas Silphidae have at least the three basal segments membranous.

The outstanding characteristic of ordinary Staphylinidae is their abbreviated elytra, but exceptions in the Omaliini (characterized by the possession of a pair of ocelli) have always been recognized. An omaliin such as *Lathrimaeum nigropiceum* Csy. has long truncated elytra that expose no more than the last two abdominal tergites. Lewis (Ann. Mag. Nat. Hist. (6) XI, 1893, pp. 394-395) described *Camioleum loripes* from Japan as an omaliin with entire (non-truncate) elytra; Casey (Ann. N. Y. Acad. Sci. IX, 1897, p. 354) indicated that *Brathinus* (formerly considered a scydmaenid) was another omaliin with entire elytra; and Bondroit (Ann. Soc. ent. Belg. LV, 1911, pp. 365-369) claimed that *Pteroloma forstroemi* Gyll., likewise with a pair of ocelli and entire elytra, should be transferred from Silphidae to Staphylinidae.

But Leng (1920) made of *Brathinus* a separate family; Bondroit's claim has been ignored; Fowler (Faun. Brit. Ind. Coleop.-Introd. 1912, p. 84) considered both *Camioleum* and *Apatetica* Silphidae; and Bernet Kempers (Ent. Mitt. XIII, 1924, p. 50) considered *Apatetica* distinctly silphid on the basis of wing venation.

The contention in this paper is that neither the texture of the abdominal tergites nor the abbreviated elytra is of any value in the definition of the Staphylinidae.

As regards the first: (1) such non-omaliin Staphylinidae as *Megarthrus, Proteinus,* and *Siagonum* have the two basal abdominal tergites membranous; (2) some of the species of the omaliin genus *Lathrimaeum* have considerable portions of the basal two tergites chitinous; (3) in such an indubitable silphid as *Silpha (Oiceoptoma) noveboracensis* Forst. all the tergites are chitinous, tho the basal ones are feebly so; and (4) in the silphid *Necrophilus subterraneus* Dahl. all but the basal tergite are very evidently corneous, and very evidently different from the basal tergite, which is membranous. Therefore it

is concluded that the structure of the abdominal tergites is a variable adaptive structure of little significance.

The primitive beetle probably resembled the cockroach and some of the lampyroid families in having long, illy-adapted elytra, and similar corneous abdominal tergites. From such a beginning there was a tendency for tergites exposed by the elytra to become more heavily chitinized and for those covered by the elytra to become increasingly less heavily chitinized and, finally, membranous. Examples of beetles without any differentiation of the tergites are some of the lampyroid beetles and *Apatetica.* Even in the typical staphylinid *(Staphylinus* and *Creophilus)* there is some slight differentiation of the tergites covered by the elytra. Examples of beetles with the basal tergites differentiated but corneous, are Histeridae and Nitidulidae with the tergites heavily corneous, and *Scydmaenus* (Scydmaenidae) and *Silpha noveboracensis* Forst. (Silphinae) with the basal tergites evidently, but feebly, chitinized. The character is evanescent, and the transition to the completely membranous basal tergites is gradual.

The variation within the Omaliinae is fatal to the short elytra. Exceptions can be tolerated when they have to do with specialized features at the tips of the phylogenetic "twigs." When, however, the primitive members of a group constitute the exceptions, the group is inadequately defined.

This leaves us, therefore, with no characters separating Silphinae and Leptininae from Staphylinidae, and they become subfamilies of Staphylinidae. The very feature, closed anterior coxal cavities, that distinguishes the other subfamilies of "Silphidae" from Silphinae, distinguishes them, likewise, from Staphylinidae, and I, therefore, group the Catopinae, Coloninae, Camiarinae, and Bathysciinae together to form a separate family, Catopidae. These matters and others are set forth in the following table,[3] in which an attempt has been made to arrange the groups in a natural sequence.

A¹. Wings not fringed
  B¹. Antennae not both geniculate and clavate
    C¹. Procoxacavae not invading metathorax
      D¹. Facets of eye normally small
        E¹. Abdominal segments not at all connate
          F¹. Procoxacavae open behind.....**STAPHYLINIDAE**
            G¹. Metacoxae contiguous or narrowly separated
              H¹. Metacoxae conical; **elytra abbreviated;** procoxae prominent

[3] Derivative characters are printed in bold-face type and intermediate characters in italics. In the Staphylinidae the subfamilies Trichophyinae, Termitidiscinae, Cephaloplectinae, Pygosteninae, Trilobitideinae, and Mimanomatinae of the Junk-Schenkling catalog are not included. For an artificial key to the subfamilies of Staphylinidae see Handlirsch, Schroder's Handb. d. Ent. III, 1923, pp. 567-569. The key to subfamilies of Catopidae is adapted from Jeannel, Arch. Zool. exp. gen. (5) VII, 1911, pp. 192-193; LXI, 1922, pp. 8-9.

I¹. Tarsi 5-segmented (rarely with middle and hind pair 4-segmented); procoxae long....Paederinae
I². Tarsi 4-segmented; *procoxae short*..Euaesthetinae
H². *Metacoxae triangular;* elytra abbreviated; procoxae prominent
I¹. Antennae normal, inserted at sides of front.... .....Habrocerinae
I². Antennae inserted at front of front...Staphylininae
H³. *Metacoxae transverse*
I¹. Procoxae prominent, conical
J¹. Lateral ocelli present; elytra long to short; sternites 7 to 5; middle coxae contiguous.. .....Omaliinae
J². Lateral ocelli absent
K¹. Elytra long; *sternites 6 to 5;* mesocoxae contiguous to separate.....Silphinae
K². Elytra abbreviated
L¹. Sternites 7
M¹. Mesocoxae contiguous .... Oxytelinae[4] (Megalopinae)
M². Mesocoxae separated ....Oxyporinae
L². *Sternites 6*
M¹. Antennae normal, inserted at sides of head
N¹. Head directed forward; body slender .....Phloeocharinae
N². Head inclined; body broader.. ..... Tachyporinae
M². Antennae inserted between eyes.. ..... Aleocharinae
I². *Procoxae short, conical;* elytra abbreviated; tarsi 2-segmented ..... Leptotyphlinae
I³. Procoxae globose
J¹. Without eyes or wings; elytra entire to abbreviated ..... Leptininae[5]
J². Elytra abbreviated; with eyes and wings.. ..... Piestinae
G². Metacoxae widely separated, small, globose; elytra abbreviated; antennae clavate
H¹. Antennae 11-segmented, inserted between eyes; club loose .....Steninae
H². Antennae 9-segmented, inserted at sides, capitate ..... Micropeplinae
F². Procoxacavae closed behind; elytra entire
G¹. Metatrochantin large .....CATOPIDAE
H¹. Metacoxae contiguous; tarsi pentamerous
I¹. Visible sternites 7 to 6; antennal club loose

[4] This subfamily includes *Phlacobium clypeatum* Muell, the only beetle, except certain Dermestidae, to possess a median ocellus.

[5] Includes *Platypsyllus:* Jeannel, Arch. Zool. exp. gen. LXI, 1922, p. 9. For keys to genera see Horn. Tr. Am. Ent. Soc. X, 1882, p. 13; Olsoufiev, Rev. Russ. Ent. XVII, 1923, p. 88.

J¹. Last segment of maxillary palpi conical or oval ..... **Catopinae**

J². **Last segment of maxillary pulpi scuriform;** New Zealand ..... **Camiarinae**

I². Sternites 5 to 4; antennal club more compact.. ..... **Coloninae**

H². **Metacoxae somewhat separated;** visible sternites 6; ♂ **tarsi 5- to 4-segmented;** ♀ **tarsi 4-segmented** ..... **Bathysciinae**

G². **Metatrochantin** small..... **ANISOTOMIDAE**

E². **Abdominal segments in part connate; elytra abbreviated..** ..... **PSELAPHIDAE, CLAVIGERIDAE**

D². **Facets of eye large; metacoxae widely separated;** elytra entire ..... **SCYDMAENIDAE**

C². **Prothorax closely fitted to metathorax so that procoxae invade mesosternum; metacoxae widely separated.....SCAPHIDIIDAE**

B². **Antennae geniculo-clavate** ....**SPHAERITIDAE, HISTERIDAE, NIPONIIDAE**

A². **Wings fringed** .....**CLAMBIDAE, PTILIIDAE, ORTHOPERIDAE, SPHAERIIDAE,** *et al.*

The Staphylinidae constitute a great aggregate of primitive staphylinoid beetles, held together by the common possession of a series of primitive characters; and from this primitive group the remaining staphylinoid families are segregated off by the possession of one or more derivative characters. Of these the Scydmaenidae are the most unsatisfactorily segregated. The Catopidae and Anisotomidae may, perhaps, be united to form a single family, in which case the name Anisotomidae will have priority. Such a union is possibly suggested by the wing folding (Forbes, Jr. N. Y. Ent. Soc. XXXIV, 1926, pp. 67-68). There is no basis for the segregation of the superfamily Silphoidea of the Leng (1920) classification.

The subfamilies of Staphylinidae are grouped primarily on the basis of coxal characters. The primitive coleopteron undoubtedly resembled the cockroach, where the coxae are contiguous, elongate, and loosely connected with the sternum. As beetles became more specialized, the coxae became more and more intimately associated with the sternum, until they became completely embedded in it, forming the globose separated coxae of the books. Four major groups are thus indicated by the increased specialization of the metacoxae. To the third of these groups belong the Omaliinae and the Silphinae.

I have made the possession of a pair of ocelli definitive for the Omaliinae. All of the Coleoptera possessing this characteristic occur in this vicinity and I believe that little violence is done by bringing them within this subfamily. It is a very primitive characteristic and, despite the modification of the metacoxae, reveal the Omaliinae as

among the most primitive of Coleoptera. The subfamily, therefore, includes *Camioleum*[6] and *Brathinus,* as recognized by the Junk-Schenkling catalog, *Pteroloma forstroemi* Gyll., formerly placed in Silphinae, and *Micragyrtes ocelligerus* Champion (Ent. Mo. Mag. LIV, 1918, p. 46) from Chili, regarded by its describer as belonging to Silphinae. *Pteroloma forstroemi* Gyll. is characterized by six visible abdominal sternites, elytra entire with nine entire striae, antennae filiform, and all but the basal one or two abdominal tergites evidently chitinized. *Micragyrtes* is described as having five sternites, elytra confusedly punctate, truncate at apex, segments 8-11 of antenna forming a compact club.

The removal of *Pteroloma forstroemi* Gyll. from the Silphinae requires that the first tribe of that subfamily take the name of Lyrosomini, Horn, 1880. The remaining species of *"Pteroloma,"* without ocelli, may be placed in **Apteroloma** gen. nov. (type *Necrophilus tenuicorne* Leconte, 1859). Finally, I see no good reason for not restoring *Apatetica* and *Nodynus* to Silphinae. *Apatetica* can not remain in Piestinae, as placed by Fauvel, because its anterior coxae are transverse and not globose. This and other genera, however, stand near the parting of the ways.

The author has attempted in the following table[7] to show to what extent larval structures corroborate adult structures in the classification of the Staphylinoidea.

A¹. Cerci usually multi-segmented.....**CATOPIDAE, ANISOTOMIDAE**
A². Cerci bisegmented (unsegmented in some Staphylinidae)
  B¹. Eyes present.....**STAPHYLINIDAE**
    C¹. Labrum present .....**Silphinae**
    C². Labrum absent .....**other Staphylinidae**
  B². Eyes absent .....**HISTERIDAE**
A³. Cerci unsegmented
  B¹. Cerci stout .....**PSELAPHIDAE(?), PTILIIDAE, PLATYPSYLLIDAE, SCAPHIDIIDAE**
  B². Cerci hairlike .....**CLAMBIDAE**
A⁴. Cerci absent.....**CORYLOPHIDAE, SCYDMAENIDAE**

In my view there is here exhibited a progressive degeneration of the cerci. It is not impossible, however, that the multi-segmented condition of the cerci of Catopoidae and Anisotomidae is the result of the secondary annulation of the second segment of a bisegmented cercus.

[6] By a curious oversight this genus is listed twice in Winkler's Cat. Col. reg. Palaear.—in Silphidae (B843) and in Staphylinidae (B3190).

[7] Compiled largely from Ganglbauer (Käf. Mitteleur. III, 1899) and Kuhnt (Ill. Best.-Tab. Käf. Deut. 1913, p. 1079-1085).

III. NOTES ON CATOPIDAE AND ANISOTOMIDAE

Catopidae

The Catopidae are a group of about 625 small, obscure, fragile, rapidly running beetles, bearing little or no superficial resemblance to the Silphinae. They seem, primitively, to have been geobious (living under stones, leaves, roots of grass, moss, etc.: *Choleva, Nargus, Colon,* some Bathysciinae) and to have branched out from this to the occupancy of a number of other situations. Different members of the family have come to occupy one or another of the following habitats: (1) decaying vegetable matter *(Catops, Choleva, Ptomaphagus);* (2) fungi *(Sciodrepa, Catops);* (3) carrion *(Ptomaphagus, Catops, Prionochaeta);* (4) ant nests *(Nemadus, Synaulus, Adelops, Attumbra, Catopsimorphus);* (5) dens of animals *(Catopidius,* some *Catops);* (6) caves *(Anemadus* subg. *Speonemadus,* Bathysciinae, and scattered species of *Dissochaetus, Ptomaphagus, Choleva, Adelops,* etc.). Specimens of *Colon* are rarely taken, and then, usually, flying or sweeping vegetation, which they climb under proper meteorological conditions in order to take flight.

Of great biological interest are the Bathysciinae, of which over 80 genera and about 270 species and 160 subspecies and varieties are recognized in Europe by Jeannel. The great majority of these are blind, inhabiting the caves of southern Europe, where Jeannel believes they arose in the Balkan Peninsula. In many cases the caves seem to have had an isolating effect similar to oceanic islands, and numerous peculiar forms have arisen in consequence. In some of the species the abdomen has become greatly enlarged and globose, paralleling, perhaps, the eccentricities of growth that are not infrequent in many myrmecophiles and termitophiles, likewise dwellers in dark places. *Platycholeus leptinoides* Horn is the only Nearctic representative of the subfamily.

The subfamilies of Catopidae are included in the key to the Staphylinoid families. Of these the Bathysciinae have been mentioned, the Camiarinae are little understood, and the Coloninae include but a single genus. The Catopinae have recently been studied by Jeannel (Arch. Zool. exp. gen. LXI, 1922, pp. 12-52). An extensive classification and phylogenetic scheme is there devised, based in important measure on the male genital tube. The following key to adults based on external characters is adapted from that work and from Jeannel, Voyage Alluaud Jeannel Afr. orient. Col. XVI, 1922, p. 235. The key to the larvae of Catopidae and Anisotomidae is taken from Ganglbauer, Käf. Mitteleur. III, 1899, pp. 208, 235, 240, and Peyerimhoff, Ann. Soc. ent. Fr. LXXVI, 1907, p. 87.

KEY TO GENERA OF CATOPINAE[8]

1 (6) Maxillary palpi filiform, 2d segment narrow, 3d segment cylindrical, elongate, longer than 2d and not much narrower; oriental, Ethiopian, neotropical ..... *Eucatopini*

2 (3) Protarsi not flattened; ♂ protarsomeres not dilated; East Africa.... ..... *Oritocatops* Port.

3 (2) Protarsi flattened; ♂ protarsomeres dilated

4 (5) Elytra transversely striolate; neotropical..... *Eucatops* Port.

5 (4) Elytra not transversely striolate; neotropical..... *Sphaerocatops* Port.

6 (1) Maxillary palpi with 2d segment oval, 3d small, conical, narrower and shorter than 2d..... **Catopini**

7 (17) Elytra transversely striolate; mesosternum carinate (except in *Dissochaetus*)

8 (12) Protibia not enlarged at apex; tibiae with 4 spines at apex.... **Anemadina**

9 (10, 11) Two basal mesotarsomeres expanded in ♂; mesosternal carina low; Mediterranean ..... *Anemadus* Reitt.

10 (9, 11) Basal mesotarsomere expanded in ♂; mesoternal carina elevated; myrmecophilous; palaearctic..... *Nemadus* Reitt

11 (9, 10) Mesotarsomeres not expanded in ♂; mesosternal carina low; neotropical, Florida ..... **Dissochaetus** Reitt.

12 (8) Protibia enlarged at apex; tibiae with fringe of spinules at apex; mesotarsomeres not expanded in ♂ ..... **Ptomaphagina**

12 (16) Pronotum transversely striolate

14 (15) Antennae normal; palaearctic, nearctic, neotropical..... **Ptomaphagus** Ill.

15 (14) Antennae short with broad oval club; myrmecophilous; North Africa ..... *Synaulus* Port.

16 (13) Pronotum not transversely striolate; cavernicolous and myrmecophilous; nearctic ..... **Adelops** Tellk.

17 (7) Elytra not transversely striolate (except *Catops decipiens* Horn); mesosternum not carinate

18 (25) Apex of protibia with 4 spines; mesotarsomeres not dilated in ♂; palaearctic ..... *Cholevina*

19 (24) Form short, convex

20 (23) Antennae normal

21 (22) Antennae without long hairs; Mediterranean..... *Nargus* Thoms.

22 (21) Antennae with long hairs; myrmecophilous; Mediterranean, Caucasus ..... *Attumbra* Goz.

23 (20) Antennae short with solid, broad, oval club; myrmecophilous; Mediterranean to India..... *Catopsimorphus* Aubé.

24 (19) Form elongate; flattened; palaearctic..... *Choleva* Latr.

25 (18) Apex of tibiae with fringe of spinules..... **Catopina**

26 (41) Basal mesotarsomere enlarged in ♂

27 (30) Pronotum wide, little narrower than elytra

28 (37) Form less elongate

29 (36) Sides of pronotum not sinuate

30 (33) Sides of pronotum recurved at base

31 (32) 8th segment of antenna narrower than 7th and 9th; palaearctic, nearctic ..... **Catops** Payk.

32 (31) 8th segment of antenna as wide as 7th and 9th; nearctic..... ..... **Echinocolus Horn**

[8] Nearctic groups in bold-face type. Numerous genera from the southern hemisphere are not included.

33 (30) Sides of pronotum not recurved at base
34 (35) Antennal club broader, 6th segment transverse; palaearctic, nearctic ..... **Sciodrepa** Thoms.[9]
35 (34) Antennal club feeble, 6th segment as long as wide; myrmecophilous; Europe ..... *Dreposcia* Jeann.
36 (29) Sides of pronotum sinuate; pholeophilous; France.... *Catopidius* Jeann.
37 (28) Form more elongate
38 (39) Antennae longer with conical club; Mediterranean, transcaspian territory ..... *Cholevinus* Reitt.
39 (38) Antennae flabellate; Alaska to British Columbia.... **Catopotrichus** Murr.
40 (27) Pronotum narrow, convex; elytra wide; Alps..... *Chionocatops* Ganglb.
41 (26) Basal mesotarsomere not enlarged in ♂
42 (33) Pronotum as wide as elytra; Siberia, Japan, nearctic.. **Prionochaeta** Horn
43 (42) Pronotum narrower than elytra; Carpathians, Himalayas..... ..... *Rybinskiella* Reitt.

KEY TO LARVAE OF CATOPIDAE AND ANISOTOMIDAE[10]

1 (12) Mandibular tooth transversely wrinkled or with transversely arranged denticles; paraglossae absent..... **CATOPIDAE**
2 (9) Antennae inserted in line with greatest transverse diameter of head; apex of mandible narrow and acute..... **Catopinae**
3 (4) Galea filiform; ligula absent; mandible without spine but with an acute dentiform appendage; eyes pigmented..... ..... **Catops, Sciodrepa**(?), **Ptomaphagus**
4 (3) Galea comb-like; ligula long; eyes not pigmented
4a (4b) Antennae evidently longer than head; mandibles regularly tridentate at apex; bristles broad..... *Anemadus*
4b (4a) Antennae shorter, scarcely longer than head; mandibles irregularly bifid or trifid
5 (6) Labial palpiger distinct; first segment of maxillary palpus shorter than second; dorsal bristles broad..... **Adelops**
6 (5) Labial palpiger indistinct; first segment of maxillary palpus longer than second
7 (8) Body elongate, covered with simple elongate bristles; 2d segment of antenna longer than first; mola of mandible distinct; cerci very long; metacoxae contiguous ..... *Catopsimorphus*
8 (7) Body short, covered with short broad bristles; antennae small; mola with feebly visible ridges; cerci short; all the coxae separated..... ..... *Synaulus*
9 (2) Antennae inserted along the front opposite the outer margin of the mandible, the apex of which is broad; bristles broad; galea comb-like; ligula long; eyes not pigmented..... *Bathysciinae*
10 (11) Mandible without spine or dentiform appendage; mola with numerous (15) ridges; maxillae elongate; 2d segment of cerci not annulated.. ..... *Aphaobius*
11 (10) Mandible with a spine or dentiform appendage; mola with fewer (8 to 10) ridges; maxillae less elongate; 2d segment of cercus annulated ..... *Bathyscia*

[9] In the author's opinion the nearctic *Catops terminans* Lec. is a synonym of *Sciodrepa fumatus* Spence, extending the range of both genus and species to the nearctic region.

[10] Nearctic groups in bold-face type.

12 (1) Mandibular tooth covered with confused tubercles; paraglossae distinct ..... **ANISOTOMIDAE**

13 (16) Head half as wide as pronotum; body narrowed behind; with ocelli

14 (15) Abdominal tergites covering pleura and stigmata; chitinous plates with short bristles; 2d segment of antenna 1½ times the length of 1st ..... **Anisotoma**

14 (14) Abdominal tergites not covering pleura and stigmata; chitinous plates with long bristles; 2d segment of antenna twice the length of 1st... ..... **Agathidium**

16 (13) Head nearly as wide as pronotum; body parallel; ocelli absent..... **Liodes**

Selected bibliography for Catopidae.—General references the same as for Silphinae, but also see Ganglbauer, Käf. Mitteleur. III, 1899, pp. 75-155, and Kuhnt, Ill. Best.-Tab. Käf. Deut. 1913, pp. 324-334, for European species. Keys to the species of the subdivisions exist as follows: **Anemadus** subg. *Speonemadus:* Jeannel, Arch. Zool. exp. gen. LXI, 1922, pp. 56-58; **Ptomaphagus:** Seidlitz, Deut. Ent. Zeit. XXI, 1887, pp. 90-93 (Palaearctic); **Nargus:** Reitter, Wien. Ent. Zeit. XXV, 1906, p. 141; **Choleva:** Jeannel, L'Abeille XXXII, 1923, pp. 1-160 (Palaearctic); **Catopsimorphus** subg. *Attaephilus:* Reitter, Deut. Ent. Zeit. XXII, 1888, p. 422; **Attumbra:** Reitter, Deut. Ent. Zeit. XXIII, 1889, p. 372; **Catops** to **Chionocatops:** Reitter, Deut. Ent. Zeit. 1901, pp. 39-48 (Palaearctic); **Rybinskiella:** Reitter, Deut. Ent. Zeit. 1913, p. 667; **Bathysciinae:** Jeannel, Arch. Zool. exp. gen. LXIII, 1924, pp. 1-436.

Only two species of Catopidae have so far been taken in Minnesota, altho ten or twelve should occur according to the distribution given in the Leng Catalog.

Adelops brachyderus Lec.

This species, placed in *Ptomaphagus* by Horn and Leng, is represented by a series of over thirty specimens from Ramsey and Hennepin Counties in the Lugger collection. It is recorded from the nest of the ant, *Camponotus pictus,* by Schwarz, Proc. Ent. Soc. Wash. I, 1889, p. 170.

Catops horniana Blanchard

This species, placed in *Choleva* in the Leng Catalog, is represented by three specimens taken on carrion in Ramsey and Anoka Counties, May and June, 1927.

ANISOTOMIDAE[11]

The members of this family are small, obscure species rarely encountered by the general collector. They inhabit decaying vegetable matter, fungi, and the subcortical region of dead trees.

[11] Liodidae of current European literature. *Liodes* Latreille, 1796, even tho it antedates *Anisotoma* Illiger 1798, can not serve as the type of the family, since it did not serve as the type of a supergeneric group until Liodini Reitter 1884, whereas *Anisotoma* served as the type of Anisotomidae Stephens 1829.

Selected bibliography for Anisotomidae.—Horn, Tr. Am. Ent. Soc. VIII, 1880, pp. 275-308; Reitter, Verh. nat. Ver. Brünn XXIII, 1884 (Best.-Tab. eur. Col. XII), pp. 91-122; Portevin, Ency. Ent. B. Col. I, 1926, pp. 75-83, and II, 1927, pp. 73-94, provide keys to the species of North America, Europe, India, and Japan, respectively. For the **Liodini** of Europe see Fleischer, Verh. nat. Ver. Brünn XLVI, 1908 (Best.-Tab eur Col. LXIII), p. 1-63. For **Scotocryptini** see Reitter, *ibid.*, pp. 91-92, and Portevin, Ann. Soc. ent. Fr. LXXVI, 1907, p. 84. Many of these works are old and the descriptions must be checked carefully against the descriptions of the more recently discovered species.

Tho ten or twelve species should occur in Minnesota according to the distribution given in the Leng Catalog, only a single species of Anisotomidae is represented in the collections of the University of Minnesota, and that a new species of a genus formerly known only by two species from Florida.

Anogdus luggeri n. sp.

With antennal and tarsal characters of genus. Length 2 mm., width 1.25 mm. Color straw yellow, somewhat darker on antennae, vertex, base of pronotum, marginal beads of pronotum and elytra, and abdomen. Head finely and uniformly punctulate. First segment of antennal club about 4/5 as wide as 2d and 3d, wider than 4th. Pronotum 56% as long as wide, apex 61% as wide as base, feebly emarginate at apex, arcuate at base, but slightly sinuate immediately mesad of the hind angles which are obtuse but distinct, sides arcuate, sides and apex very finely margined, disc finely punctulate. Elytra with eight finely punctate striae, not or feebly impressed. Intervals finely punctulate. Margin with short stiff yellow hairs. Legs with coarse stiff yellow hairs.

Type: "Minn." from Otto Lugger collection in the University of Minnesota insect collection.

Key to species of Anogdus Lec.

A¹. Pronotum less than twice as wide as long, disc finely punctate, base arcuate; elytral striae finely punctate

B¹. Hind angles of pronotum distinct; 7th segment of antenna nearly as wide as 8th and 9th, wider than 10th; pronotum 56% as long as wide; length 2 mm.; Minn. ..... **luggeri** n. sp.

B². Hind angles of pronotum rounded; 7th segment of antenna not much more than half as wide as 8th and 9th, same width as 10th; length 2.2-2.4 mm.; Fla. ..... *dissimilis* Blatch.

A². Pronotum three times as wide as long, disc coarsely punctate, base truncate, hind angles rounded; elytral striae crenately punctate; 7th segment of antenna as wide as 8th and 9th, wider than 10th; length 2.5 mm.; Fla. ..... *capitatus* Lec.

This opportunity is taken to describe a second new anisotomid in the Lugger collection, apparently from Alaska.

Hydnobius luggeri n. sp. ♂ Length 2.5 mm.; width through pronotum 0.9 mm., through elytra 1.3 mm. Throughout reddish brown, shining. Labrum bilobed. Head and pronotum sparsely punctate, the punctures finer than those on elytra. Third segment of antenna shorter than next two. Pronotum 77% as long as wide at base, 88% as wide at apex as at base, anterior angles rounded, posterior angles feebly prominent, obtuse; sides arcuate, just visibly wider in front of base; base and apex arcuate. Elytra with about 18 rows of punctures, the second or sutural and the 18th or marginal impressed, the sutural not impressed for basal fifth; the punctures of the 15th and 17th rows somewhat smaller; the intervals of the rows of punctures not strigose or wrinkled. Four basal segments of pro- and mesotarsi dilated. Profemur oblong, 30% as wide as long, inner margin simple. Metafemur broad, arcuate along inner margin. Metatibia straight.

Type: "R.A." in Otto Lugger collection, University of Minnesota.

This species, undoubtedly from Alaska, runs to *obtusus* in Horn's key, but it is separated from that species by its slenderer profemur, the inner margin of which is not broadly lobed, and by the extensive development of the interstrial puncture-series, so that there appear to be 18 nearly equal rows of punctures on each elytron.

The distribution of the Minnesota species mentioned in this paper is summarized in the accompanying table. The number of species is not extensive enough to warrant distributional conclusions.

	Palaearctic	Alas., N.W. Ter.	Pacific	Rocky Mts.	N. Gt. Plains	Minn.	Wis., Ont., Mich.	Neb., Kan., Ind.	N.E. N. Am.	S.E. N. Am.	Gulf St.	S.W. St.	Neotropical
Silpha trituberculata...		x			x	x	x						
lapponica	x	x	x	x	x	x	x	x	x			x	x
noveboracensis				x	x	x	x	x	x	x			
ramosa			x	x	x	x	x						
americana					x	x	x	x	x	x	x	x	x
Necrodes surinamensis..				x	x	x	x	x	x	x	x	x	?
Nicrophorus orbicollis..					x	x	x	x	x	x	x		
sayi				x	x	x	x	x	x	x	x		
americanus						x	x	x	x	x	x		
defodiens		x	x	x	x	x	x		x				
pustulatus	x	x	?	x	x	x	x	x	x	x	x		
hybridus			x	x	x	x			?			?	
obscurus				x	x	x	x						
marginatus		x	x	x	x	x	x	x	x	x	x	x	x
tomentosus			x	x	x	x	x	x	x	x	x	x	
Catops horniana.....					x	x		x					
Adelops brachyderus....						x	x		x				
Anogdus luggeri						x							